

December 12, 2011

BY E-MAIL TRANSMISSION

Peter M. Felitti, Esq.
USEPA Region 5
Mail Code: C-14J
77 West Jackson Boulevard
Chicago, IL 60604

BY E-MAIL TRANSMISSION

W. Owen Thompson
Remedial Project Manager
Superfund Remedial Response Section
Seven USEPA Region 5, SR-6J
77 W. Jackson Boulevard
Chicago, IL 60604

**Re: Fields Brook Action Group Comments on Proposed ESD
for Detrex Corporation Source Area (OU5) – Fields Brook
Superfund Site, Ashtabula, Ohio**

Dear Messrs. Felitti and Thompson:

As a follow up to our meeting on November 16, 2011, and in response to your request, enclosed please find various comments from the Fields Brook Action Group (“FBAG”) regarding the draft Explanation of Significant Differences (“ESD”) for the Detrex Corporation Source Area prepared by the United States Environmental Protection Agency (“USEPA”) dated October 2011. These comments are submitted on behalf of all of the FBAG member companies except Detrex Corporation. By this submission, the FBAG has provided USEPA with more expansive and detailed comments concerning remedial action to address DNAPL containment at the Detrex facility, which supplement those presented verbally during our prior meetings and transmitted through earlier written submittals to the Agency.

The comments explain that the changes envisioned by the draft ESD fundamentally alter the ROD-selected remedy and do not meet the ROD-defined objectives for the Detrex facility by substituting a passive containment system in place of an aggressive treatment remedy. Moreover, the proposals embodied by the ESD are inconsistent with USEPA’s policy for treatment of a Principal Threat Waste represented by the extensive DNAPL containment at the Detrex site. As a result, the ESD improperly attempts to achieve these changes without compliance with ROD amendment procedures required by applicable regulations and EPA ROD guidance, thereby jeopardizing the \$60 million investment made by the FBAG members in the remediation of Fields Brook.

In addition, the FBAG comments describe why the containment measures implemented to date by Detrex have been ineffectual, and they provide substantive proposals for the design and implementation of an effective vacuum-enhanced extraction system for the removal of DNAPL from the primary source area at the Detrex facility. Gradient Corporation and Haley & Aldrich have prepared this joint submission to maximize their respective capabilities. As you are aware, Gradient has extensive knowledge related to the overall Fields Brook site and the DNAPL containment present at the Detrex facility. Haley & Aldrich pioneered vacuum enhanced remediation technologies in the late 1980s, and has wide-ranging experience in designing and operating vacuum extraction systems, including for remediation of DNAPL at other low hydraulic conductivity sites similar to the Detrex facility. Haley & Aldrich worked closely with Gradient in developing the detailed comments related to the redesign of the DNAPL extraction system for the Detrex facility.

The FBAG and its technical consultants are willing to assist in the review of a work plan and design documents prepared by Detrex to reflect implementation of these comments. The FBAG does not believe that the current ESD is necessary to implement the proposals incorporated in its comments. Indeed, the FBAG's comments make clear that the draft ESD actually anticipates an amendment to the current ROD which is neither appropriate nor necessary.

After you have an opportunity to review the substantive comments submitted by the FBAG, please let me know what steps the Agency envisions from this point forward.

Very truly yours,



Ralph E. Cascarilla

On behalf of the FBAG companies

REC/rd

Enclosure

cc: All Members of Fields Brook Action Group

THE FIELDS BROOK ACTION GROUP COMMENTS ON PROPOSED ESD FOR DETREX CORPORATION SOURCE AREA (OU5) FIELDS BROOK SUPERFUND SITE, ASHTABULA, OHIO

December 12, 2011

SUMMARY

USEPA has issued a Draft Explanation of Significant Difference (ESD) for the Detrex Source Control Operable Unit (SCOU) at the Fields Brook Superfund Site, in Ashtabula, Ohio, and solicited comments from the Fields Brook Action Group (FBAG) related thereto.¹ These comments are the latest submission by the FBAG related to ongoing source control failures at the Detrex Facility, and should be considered as supplemental to the FBAG's prior verbal and written comments provided to USEPA. The proposed ESD (USEPA, 2011) would essentially eliminate the active treatment portion of the remedy specified in the Record of Decision for the Detrex Facility (ROD; USEPA, 1997a), and would substitute a remedy predicated on containment. As the changes contemplated by the draft ESD fundamentally alter the remedy selected in the ROD, they are being improperly attempted through the use of an ESD rather than the ROD amendment procedure required by applicable regulations and USEPA ROD Guidance.

The ROD remedy consisted of containment (a slurry wall and hydraulic controls) together with active removal and treatment of Dense Non Aqueous Phase Liquid (DNAPL) present at the Detrex Facility using vacuum enhanced extraction (VE). As stated in the ROD, USEPA selected this "aggressive" treatment approach after careful consideration of other remedial options. For the last 10 years, Detrex has unsuccessfully operated a pilot-scale system and only installed 14 of the 40 DNAPL VE extraction wells required by the ROD. The pilot system was poorly designed, barely met the technical requirements of the ROD, and poorly implemented, resulting in continuous reports of operational difficulties. Notwithstanding these inadequacies in design and implementation, the pilot-scale system was able to remove 16,000 gallons of DNAPL (out of an estimated 250,000 to 1,000,000 gallons) from the former lagoon area at the Detrex Facility. By its draft ESD, USEPA proposes to change the active ROD remedy to a passive DNAPL containment system, consisting of a 1900 foot long slurry wall and passively operated DNAPL recovery wells to be located along the northern edge of the former lagoon area. DNAPL-contaminated soils excavated from the proposed slurry wall and recovery wells would be managed on-site, placed on the former lagoon area, and capped.

The Detrex approach to DNAPL recovery has been flawed from the outset. The inability of Detrex to produce the results required by the ROD is not an inevitable result of site conditions; Detrex's failure to perform is the direct result of shortcomings in the design, implementation, and operation of the pilot system used to date to recover DNAPL. The ineffective implementation of the ROD-required remedy has allowed for the continued manifestation of DNAPL in the DS Tributary. The repeated recontamination of the DS Tributary has undermined the short term protectiveness of the Detrex remedy, as recognized by USEPA in its Second Five-Year Review (USEPA, 2009).

As US EPA requested, in these comments FBAG is providing specific recommendations for correcting deficiencies in the design and operation of the VE extraction system. When properly designed and implemented, such a system will effectively remove DNAPL from the Detrex source area(s), without the recurrent operational difficulties that past operators of the Detrex pilot system have reported, such as

¹ Although a member of the FBAG, these comments are not submitted on behalf of Detrex Corporation.

excessive well siltation, product crystallization, and emulsion formation. Specifically, we recommend that:

- VE wells be installed directly within the former impoundment area where the greatest thickness of DNAPL is expected to be present;
- A high-vacuum, low-flow pump be utilized to apply vacuum to the well bore, and that individual down-hole groundwater and product pumps also be used to manage gradients and extract mobilized DNAPL;
- The VE system be continually and actively operated, rather than passively and intermittently, as has been the case in the past; and
- Appropriate data be collected once the VE system starts operating so that system operations can be optimized.

The ROD-required remedial technology (vacuum-enhanced extraction), when implemented properly, has been successfully used to remediate chlorinated DNAPL at other low hydraulic conductivity sites. This preferred remedial technology is capable of meeting the ROD-defined remedial objectives of permanently removing and treating a Principal Threat Waste, halting the continuing migration of mobile DNAPL, and protecting the remedy that the FBAG has already completed in the sediment and floodplain operable units for Fields Brook.

The passive remedy proposed in the draft ESD is *fundamentally* different from the remedy specified in the ROD – and in fact, is similar to an alternative that USEPA expressly rejected in the ROD. Furthermore, the proposed ESD remedy will not achieve ROD-defined remedial action objectives that are crucial to the protection of Fields Brook—as should be clear from the repeatedly documented instances of migrating Detrex DNAPL along the western property boundary where a slurry wall has been in place for some time now. The proposed remedy amounts to a passive "containment" system, which is not appropriate for a site with significant quantities of DNAPL, a Principal Threat Waste. The ROD correctly selected an active and aggressive treatment approach precisely for the purpose of targeting and permanently removing a significant volume of Principal Threat Waste at the Detrex source area(s). The ROD-defined remedy is appropriate, consistent with USEPA's Principal Threat Waste guidance, and in accord with CERCLA's mandate: "*Remedial actions in which treatment which permanently and significantly reduces the volume, toxicity or mobility of the hazardous substances, pollutants, and contaminants is a principal element, are to be preferred over remedial actions not involving such treatment.*" 42 U.S.C. § 9621(b)(emphasis added). Vacuum-enhanced extraction is the remedy that USEPA has required at similar sites, and it is capable of being implemented effectively at the Detrex Facility, provided that USEPA takes steps to ensure that the system is designed and operated in accordance with industry best practices, as outlined in the recommendations below.

DETAILED FBAG COMMENTS

1. The remedy proposed in the ESD is a containment remedy that differs fundamentally from the ROD remedy and will not meet the ROD-defined objectives for the Detrex facility. Detrex should be required to implement the remedy selected in the ROD since it is consistent with EPA's policy regarding remedial actions required at Principal Threat Waste sites. In addition, the ROD remedy (vacuum-enhanced extraction) has been shown to work at other sites, and if implemented properly, will effectively manage and remove DNAPL from the Detrex source area(s). Furthermore, the proposed expansion of the slurry wall is not an optimal use of resources at the

present time, which would be better spent on removing DNAPL and neutralizing the threat of ongoing migration to the sediment and floodplain of Fields Brook and its tributaries.

(a) The ROD selected an aggressive DNAPL extraction and treatment remedy for the Detrex source area that is consistent with USEPA guidance for a Principal Threat Waste that poses an ongoing risk of recontamination to Fields Brook and the DS Tributary.

The Detrex remedy selected in the ROD, Alternative IV, consisted of "containment" and "treatment" elements. Containment was to be achieved using a slurry wall and groundwater withdrawal. Extraction and permanent destruction of DNAPL in the primary DNAPL source area were to be achieved using vacuum-enhanced extraction wells in and around the former lagoons (USEPA, 1997a). Treatment was a key component of the selected remedy because Detrex DNAPL is a Principal Threat Waste, as defined by USEPA guidance (USEPA, 1991). Consequently, the ROD selected a remedy that would treat the source area and minimize the risk of recontamination of Fields Brook (SCOU ROD, p. 45):

"Alternatives IIB, III and IV satisfy the preference for treatment of principal threat contaminants (i.e., the DNAPL) that could potentially recontaminate Fields Brook sediment."²

As correctly acknowledged in the ROD, Detrex DNAPL meets USEPA (1991) criteria for a Principal Threat Waste, defined as material that is: "highly toxic or highly mobile that generally cannot be reliably contained or would present a significant risk to human health or the environment should exposure occur" (USEPA, 1991, p. 2). Given the high toxicity and mobility of the Detrex DNAPL and the significant amount of DNAPL present at the Facility [ROD estimated aerial extent of DNAPL was 11.5 acres (p. 11)], the emphasis placed by the ROD on removal and treatment of DNAPL in the Detrex source area was appropriate and necessary.

The ROD recommended installation of 40 vacuum-enhanced extraction wells to address the DNAPL. Among USEPA's key reasons for selecting this approach (Alternative IV) were that it would aggressively address all phases (residual, dissolved, vapor, and liquid) of the DNAPL (ROD, p. 45).

"DNAPL would be treated and destroyed under Alternatives IIB, III, and IV. However, more DNAPL removal is anticipated with the more aggressive [(emphasis added)] vacuum-enhanced groundwater/DNAPL removal systems (Alternative III and IV). All DNAPL that would be separated from groundwater would be destroyed by treatment or recycling. Dissolved-phase and vapor-phase DNAPL constituents would be absorbed onto activated carbon and would be destroyed during regeneration."

In the ROD, USEPA properly determined that this approach, aggressively addressing all DNAPL phases, was consistent with applicable Principal Threat Waste guidance. The ROD stated that (p. 44):

"USEPA's TBC guidance indicates that long-term remediation objectives of DNAPL remedies should be to remove free-phase, residual and vapor phase DNAPL to the extent practicable."

The ROD selected a source remedy (vacuum-enhanced extraction) that would aggressively treat all phases of DNAPL at the Detrex Facility because DNAPL is a Principal Threat Waste. Given the significant volume of DNAPL present at the Detrex Facility, its high toxicity and mobility, and the

² Alternative IIB consisted of a slurry wall and source treatment using a deep trench system, whereas Alternative III consisted of a vacuum-enhanced extraction system, but no slurry wall.

significant risks that mobile Detrex DNAPL poses to human health and the environment, the remedial approach selected in the ROD was appropriate.

(b) The ESD is inconsistent with the remedy specified in the ROD because it substitutes a passive containment system that fails to meet the "treatment" objective – a requirement of the EPA Principal Threat Waste site remediation policy – and would likely allow for the continued contamination of the DS Tributary and Fields Brook. Moreover, a system analogous to the ESD remedy was previously evaluated and rejected in the ROD (Alternative IIB).

For 10 years, Detrex has been operating a pilot DNAPL removal system that, despite its shortcomings and being passive in nature, has removed 16,000 of the estimated 250,000 to 1,000,000 gallons of DNAPL in the primary source area. The remedial system proposed in the ESD includes the extension of the existing slurry wall by 1900 feet to the south and east, and the installation of an additional 18 DNAPL recovery wells along the northern property boundary of the Detrex Facility (USEPA, 2011). The proposed DNAPL recovery system is "designed to operate primarily in passive mode", with only intermittent application of vacuum using a Mobile DNAPL Recovery Unit (MDRU) to remove any DNAPL that has accumulated in the wells (USEPA, 2011).

The current pilot system and the proposed full scale system in the ESD are little more than "containment" systems aimed at collecting DNAPL that may flow into the recovery wells. Expansion of the slurry wall proposed in the ESD is not an optimal use of resources at the present time. It would be more appropriate to focus on neutralizing the source *via* aggressive removal techniques (as required in the ROD) before contemplating such containment measures. Those measures were meant to compliment, not replace primary source treatment. As proposed, the ESD approach does not meet the "treatment" requirement for a Principal Threat Waste (discussed in section (a) above), and is fundamentally different from the "more aggressive" remedy that USEPA expressly adopted in the ROD. Specific differences between the remedy proposed in the ESD and the remedy mandated by the ROD include the following:

- The ROD required installation of vacuum-enhanced recovery wells directly within the footprint of the former lagoon area – an approach that would maximize contaminant mass removal rates. However, the remedy proposed in the ESD would be limited to placement of DNAPL recovery wells and a slurry wall along the outside edges of the former Detrex lagoon area. To be clear, Detrex has proposed a remedial goal—containment outside the former lagoon area—this is fundamentally at odds with the remedial goal that USEPA established in ROD, *i.e.*, maximizing DNAPL extraction and permanently removing it from the environment. Passive collection of DNAPL along the outside edges of the lagoon area, rather than throughout the lagoon area, is a much less efficient remedial approach.
- The ROD selected vacuum-enhanced extraction to *aggressively* remove DNAPL, contaminated groundwater, and vapors at the Detrex Site. In contrast, the ESD remedy is designed to operate primarily in passive mode, with intermittent application of vacuum to remove DNAPL that may flow into wells *via* gravity drainage between pumping events. Intermittent application of vacuum is extremely inefficient and will remove limited quantities of DNAPL from the subsurface when compared to a continuously operated system. Worse, as explained below, intermittent application of vacuum actually inhibits the flow and recovery of DNAPL by causing siltation and “snap off.”
- Although the MDRU for the proposed remedial system will be equipped to recover and treat vapor and dissolved phase contamination, passive operation of the recovery wells and intermittent application of vacuum will only allow recovery of free-phase DNAPL

that may flow passively (due to gravity) into the wells. In contrast, consistent with USEPA guidance, the ROD required that all phases of DNAPL (residual, vapor, dissolved, and free-phase) be addressed by the remedy selected.

Allowing Detrex to revert to a containment-based remedy as envisioned by the ESD would constitute a reversal of USEPA's prior administrative determination at this site. The ROD evaluated a remedial system analogous to the ESD remedy that contained a large slurry wall for containment and a deep trench system with submersible pumps for "active" recovery of DNAPL and groundwater (Alternative IIB; USEPA, 1997a). During the remedy selection process, Alternative IIB was *rejected*; Alternative IV (vacuum-enhanced extraction) was selected, among other reasons, because it would result in higher DNAPL removal rates and address all phases of DNAPL (residual, vapor, dissolved, and free-phase). Given that the DNAPL recovery process in the proposed ESD remedial system (gravity drainage) is even more passive than that in the Alternative IIB system that was rejected in the ROD (active pumping), the ESD remedy should be rejected for the reasons stated in the ROD.

The failure of the current pilot system to meet the "treatment" objective of the ROD over the course of ten years of work ineffectually conducted has resulted in continuing migration and manifestation of DNAPL in Fields Brook and the DS Tributary. In the Second Five Year Review, USEPA acknowledged that this continuing failure of source control posed a threat to the protectiveness of the remedy (USEPA, 2009):

"In addition, the continued assessment of the contamination seen in the DS Tributary, just west of State Road, may ultimately lead to a reassessment of the short-term protectiveness of the remedy. If investigations indicate that the DNAPL in the DS Tributary is due to a failure of the existing DNAPL control measures, additional work will be required to correct the situation." (p. 27)

Allowing Detrex to implement the measures it proposes to institute in place of the more aggressive remedy required by the ROD would contravene USEPA's prior administrative determinations and would result in continuing contamination of the DS Tributary and Fields Brook.

Detrex has failed over the past 10 years to properly install and operate a VE extraction system (a proven technology at similar sites) that is capable of protecting the DS Tributary and Fields Brook from continued contamination. The ongoing contamination is a failure of Detrex to properly implement the selected ROD remedy, not a failure of the selected remedy itself. Detrex should not be rewarded for its ineffectual and failed attempts to implement the permanent treatment remedy that USEPA previously selected, and that USEPA's guidance and CERCLA mandate.

(c) The ROD-defined remedy was appropriate and in keeping with remedies selected and implemented at other DNAPL sites. Vacuum-enhanced extraction has been used successfully to remediate a number of other sites with chlorinated DNAPL mixtures, and if properly implemented, will successfully extract DNAPL from the primary source area at the Detrex Facility.

The remedy selected by USEPA in the ROD was and remains the appropriate remedy, because it complied with the nine remedy selection criteria specified in the National Contingency Plan (NCP) and with USEPA's guidance for Principal Threat Waste at DNAPL sites. Furthermore, it remains consistent with contemporary wisdom that reaffirms the application of aggressive source control measures at large DNAPL sites, and with recent and analogous remedy decisions by USEPA.

The ROD correctly selected a remedy that offered the highest degree of protection by removal and treatment of all phases of DNAPL in an "aggressive" manner. The selection of an aggressive

remedial approach for the Detrex Facility was not only appropriate, but also consistent with the remedial philosophy being applied by USEPA at other Principal Threat Waste sites. Where large quantities of DNAPL are present in the subsurface, as is the case here, USEPA has required that aggressive measures be undertaken to excavate, flush, extract or otherwise remove DNAPL. In such instances, USEPA has been clear that containment is not an appropriate option. For example, at the Ashland/Northern States Power Lakefront Site, located in Ashland County, Wisconsin (a USEPA Region 5 site), the ROD issued in September 2010 requires excavation and disposal of 286,000 yd³ of DNAPL-contaminated sediment (USEPA, 2010). In addition, a review of USEPA's ROD database indicates that USEPA has consistently required implementation of aggressive source removal and/or treatment remedies at Principal Threat Waste sites. No justification for abandoning the ROD remedy is provided in the ESD.

The remedial approach selected in the ROD is a proven technology that has been successfully used to remediate a number of DNAPL sites around the country. The ROD acknowledges in numerous places that vacuum-enhanced extraction is a proven approach:

"Vacuum-enhanced extraction wells (Alternatives III and IV) are effective and reliable...." (p. 44)

"The technologies included under Alternatives IIA, IIB, III, and IV are demonstrated technologies that have been constructed at similar sites.There are no expected difficulties or uncertainties associated with construction of the vacuum-enhanced extraction well system in Alternatives III and IV. Recent pilot-scale tests completed at the site have evaluated the feasibility and effectiveness of the technology in extracting DNAPL and groundwater. Based on these preliminary tests, the technology is feasible, although yields will be relatively low." (p. 46)

Since the issuance of the ROD, USEPA guidance documents have become available that present best practices, technical considerations, and case studies associated with vacuum extraction technologies (also sometimes referred to as Multi-Phase Extraction or MPE). Examples of these resources include: Multi-Phase Extraction - State of the Practice (USEPA, 1999) and Multi-Phase Extraction Technology for VOCs in Soil and Groundwater (USEPA, 1997b). These guidance documents clearly indicate that vacuum-enhanced extraction is one of the remedial technologies appropriate for remediating low hydraulic conductivity sites contaminated with DNAPL and is the presumptive remedy at VOC sites with soil and groundwater contamination. These and other documents present a number of case studies/sites where this remedial approach has been successfully used to remediate DNAPL-impacted sites (USEPA, 1997b, 1999; NNEMS, 2010).

(d) The ESD's proposal to manage contaminated soils at the Facility by creation of a DNAPL Soils Management Area is not consistent with the ROD, violates CERCLA's preference for permanent treatment, and would pose an impediment to future remedial efforts mandated by the ROD in the primary DNAPL source area.

Detrex is proposing to place DNAPL-contaminated soils generated from the drilling of additional DNAPL recovery wells and the installation of the slurry wall/groundwater collection trench in a DNAPL Soil Management Area to be located in the center of the primary DNAPL source area. The DNAPL Soils Management Area will contain approximately 315 yd³ of soil, have a foot print of approximately 0.13 acres, and will be covered with a geomembrane and geotextile cap (URS, 2011).

Detrex's proposals to manage contaminated soils on-site and to create a DNAPL Soil Management Area constitute significant deviations from the ROD. The proposed approach will create a permanent waste management area, which in all likelihood, will contain DNAPL-saturated soils. In addition, creation of this capped waste management unit will effectively eliminate access to this area for

installation of vacuum-enhanced recovery wells. Placing additional DNAPL-contaminated soils in the primary source area would not result in any permanent treatment and would not reduce risks associated with this material. Although this approach poses an impediment to the implementation of the ROD-approved remedial approach in the source area, no defensible rationale was provided in the ESD for this significant deviation from the ROD.

2. Although containment measures, such as the proposed slurry wall, can complement source removal, resources at this juncture should be focused on actively removing DNAPL from the Detrex source area. We believe that vacuum enhanced (VE) extraction can successfully remove DNAPL from the primary DNAPL source area and render this material immobile if: a) -properly designed VE wells are installed within the former impoundment area where the greatest thickness of DNAPL is expected to be present; b) a high-vacuum, low-flow pump is utilized to apply vacuum to the well bore, while independent down hole pumps are used to manage the water table and extract mobilized DNAPL; c) the VE system is continually and actively operated; and d) appropriate data are collected once the VE system starts operating so that system operations can be optimized. Each of these recommendations, which are discussed in detail in the following sub-sections, will also eliminate the operational difficulties that Detrex has reported having with the existing pilot-scale remediation system, i.e., excessive well siltation, product crystallization, and emulsion formation.

(a) The current and proposed DNAPL recovery wells are not appropriately placed to effectively recover DNAPL. In order to effectively recover DNAPL from the source area and neutralize continuing migration of the Detrex Principal Threat Waste, extraction wells should be installed in the former lagoon areas, where the greatest thickness of DNAPL is expected to be present.

Recovery Well Placement Currently Used by Detrex

To date, Detrex has installed 14 of the 40 DNAPL extraction wells contemplated in the SCOU ROD (USEPA, 1997a). These extraction wells are oriented in a V-shaped pattern in the northern portion of the Facility along the periphery of the former impoundment area. The placement of the wells along the edges of the primary source area is sub-optimal because DNAPL has to flow from the former impoundment area to the wells (by gravity) before it can be captured. This placement of wells is serving to expand the DNAPL plume by pulling it towards the edges, rather than shrinking the plume (the typical objective for remediation). Despite the poor well locations (i.e., approximately 100 feet away from the center of the former impoundment area), several feet of DNAPL (up to 8 feet) continues to accumulate in the current recovery system's monitoring wells (Figure 1), a clear indication of the volume of recoverable DNAPL present at the former impoundment area.

Recommended Recovery Well Placement

Detrex should install active DNAPL extraction wells in the heart of the DNAPL plume (i.e., within the former impoundment area) where the greatest thickness of DNAPL is expected to be present and has been observed in monitoring wells. Placement of extraction wells within rather than around the impoundment area is consistent with the well layout recommended in the ROD (Figure 2). By starting at the source, the extraction wells will draw DNAPL inward towards the center of the plume, instead of the current (and proposed) wells that are on the periphery of the plume and will spread the plume. We recommend starting with a small number of extraction wells (e.g., 4 to 6 wells) in the center of the DNAPL source area and collecting detailed observations of system performance so that the well configuration can be optimized and then expanded to a full scale system. In summary, placement of

DNAPL recovery wells in the center of the former impoundment area is expected to be much more efficient than the approach proposed in the ESD and will significantly increase DNAPL removal rates.

(b) The current Detrex remedy utilizes equipment that is inappropriate for site conditions and impairs DNAPL removal efficiency. The system design needs to be modified by installing larger diameter extraction wells, utilizing a high-vacuum pump, and operating groundwater and DNAPL extraction systems in a manner that maintains a steady and continuous rate of fluid recovery.

System Design Currently Being Used and Proposed by Detrex

The current Detrex DNAPL recovery system utilizes equipment that is not appropriate for site conditions (e.g. improper well design, wrong type of vacuum pump) and therefore reduces DNAPL removal efficiency. The recovery wells are small in diameter (originally only 2-inch diameter) and are not designed or operated in a manner that can effectively apply vacuum to recover DNAPL present in the subsurface. The current Detrex design creates a minimal amount of suction on the DNAPL layer, using a small positive displacement pump and suction manifold connecting this single pump to multiple wells, making the design little more than a passive remedy. In order for the applied vacuum to mobilize DNAPL into the recovery well and remove accumulated free product, the water level in the well must be simultaneously drawn down³. The combined action of applying vacuum and drawing down the water level in the well will maximize the well's potential to draw DNAPL into it. Since Detrex does not simultaneously apply vacuum and extract groundwater from its recovery wells, the applied vacuum, does not allow for effective DNAPL recovery.

Furthermore, the vacuum pump that Detrex has utilized is a low-vacuum (vacuum of about 5 inches of mercury) high-flow pump that is not suitable for vacuum-enhanced DNAPL recovery. Given the low vacuum being applied, even if the recovery wells were properly designed and operated, the vacuum would not be sufficient to significantly induce DNAPL from the formation to flow towards the well. Thus, the system has always operated and would continue to operate as a gravity drainage system—an ineffective method for DNAPL extraction. Schematic drawings of the passive recovery wells currently in operation at the Detrex facility and/or proposed by Detrex (URS, 2011) are shown in Figure 3. The figure has been annotated to point out some of the design flaws in the proposal.

Recommended System Design

Detrex should redesign its system so that it can function as an active and effective DNAPL extraction remedy. Extraction wells should be larger in diameter so that they can accommodate the equipment needed for monitoring and extraction of groundwater and DNAPL. The screened interval of the wells should be narrowly constrained to the DNAPL bearing zone, so that only groundwater and DNAPL (i.e., minimal vapor stream) are produced from the well. DNAPL should be extracted *via* a dedicated submersible positive displacement pump installed in an unscreened sump at the bottom of the well that extends into the glacial till. An interface probe should be utilized to ensure that DNAPL is not

³ In order for the applied vacuum to effectively draw DNAPL into the well, the groundwater level in the well also must be drawn down. Without drawing down the water table, the applied vacuum merely induces more groundwater to flow into the well (analogous to sucking water up a straw). In order to transfer the applied vacuum to the DNAPL that lies at the bottom of the well/aquifer, the groundwater in the well must be drawn down simultaneously. Under such a configuration, the total suction (measured in units of feet of water) applied to the DNAPL layer is equal to the applied vacuum plus the groundwater drawdown in the well. The current Detrex design uses a single positive displacement groundwater pump, and the well/pump configuration limits the effective suction on the DNAPL layer to a few feet at best, which is a very small suction and amounts to little more than a passive remedy. In a properly designed well, the amount of suction that can be applied to the Detrex DNAPL at the bottom of such recovery wells could be in excess of 30 feet (vacuum >25 feet plus drawdown >5 feet)—i.e., approximately ten times greater than that currently being applied by Detrex.

"over pumped" (see Figure 4). This configuration would allow for DNAPL to be slowly, but continuously, extracted from the well while a high vacuum is applied to the well's headspace.

For applying vacuum, Detrex should utilize a high-vacuum (*i.e.*, a vacuum of 25 inches of mercury or greater), low-flow pump, consistent with industry best practices for DNAPL extraction in similar low permeability settings. The extraction wells should also have a groundwater extraction pump (above the top of the DNAPL layer but below the minimum desired groundwater level in the well) so that the well's water level could be drawn down simultaneously as vacuum is being applied. A level control should be used in conjunction with the groundwater pump to ensure that the water table stays sufficiently above the DNAPL layer to prevent mixing of the two fluids. Drawing down the well's water level while simultaneously applying vacuum to the well's headspace will maximize the induced DNAPL gradient toward the well, and will considerably increase DNAPL recovery rates. In addition, continuous pumping of DNAPL will minimize the emulsion and crystallization formation problems reportedly observed at the current system.

(c) The passive Detrex DNAPL recovery system is being operated ineffectively on an intermittent basis and should be redesigned to actively extract DNAPL on a continuous basis.

Operational Practices Currently Used by Detrex

Detrex currently operates its DNAPL recovery system using an intermittent, passive approach, where accumulated DNAPL in the recovery wells is periodically pumped out. This intermittent operation of the system remedy has failed to create a capture zone to mitigate outward DNAPL migration, has amplified the production of silt, and has agitated DNAPL in ways that can alter its ability to readily flow into the well. The capture zone of recovery wells currently operated by Detrex is the smallest possible, because DNAPL only flows towards the wells under the influence of gravity. Thus, the intermittent pumping merely removes accumulated DNAPL from recovery wells periodically and does not actively induce DNAPL to flow towards the wells. The intermittent pumping has also contributed to excessive silt production in the recovery system. Every time this system is started and stopped, the recovery wells are in essence "surged," and this surging causes silt from the well pack area to be mobilized into the collection system. This silt mobilization is similar to what is experienced during well development (*e.g.*, development of monitoring wells), and would not occur if the system were operated continuously. Lastly, Detrex's practice of periodic evacuation of DNAPL from recovery wells can cause "snap off" and temporarily interrupt free product recharge. Snap off is a phenomenon where groundwater in the well casing blocks DNAPL flow into the well, and can occur when most or all DNAPL is removed from a well in a single pumping event. When this condition is allowed to occur, a well appears to be depleted of mobile DNAPL and provides a false indication of performance. This condition also contributes to the formation of emulsions and adds to the cost of treatment operations.

Recommended Operational Practices

The Detrex DNAPL extraction system should be designed for and operated on a continuous basis (*i.e.*, 24 hours a day, 7 days a week). By applying high vacuum (25 inches of mercury or more) on a continuous basis and maintaining stable extraction conditions (liquid production), both the well's effective radius of influence and DNAPL recovery will be maximized. However, care should be taken to avoid over pumping DNAPL (*i.e.*, pumping all DNAPL out of the well at once or pumping out excessive amounts of groundwater while extracting DNAPL) as this can cause "snap off" and interrupt free product recharge to the extraction well. In order to prevent excessive pumping (and as a good management practice in general) product interface probes should be installed and monitored regularly. As the site responds to simultaneous groundwater pumping and DNAPL extraction, probe on/off settings will require

adjustment to maintain optimum pumping rates and thereby maximize DNAPL extraction. Finally, these operations should be overseen by trained professionals, who have experience in designing and operating DNAPL recovery systems in settings similar to Fields Brook. Detrex personnel (who are dedicated to facility operating priorities and do not have experience with state-of-the-art DNAPL recovery systems) should not be in charge of system operations, as proposed in the URS work plan (URS, 2011), and as may have been the case in the past.

(d) The current Detrex monitoring and data collection program is insufficient and should be augmented to include higher frequency (i.e., daily and weekly) measurements of an expanded list of parameters so that the extraction system can be optimized and properly scaled up.

Monitoring and Data Collection Currently Done by Detrex

According to the remedy's O&M Plan (URS, 2008), Detrex currently estimates flow volumes from passive DNAPL recovery wells on a daily basis and monitors the following parameters in monitoring wells on a quarterly basis :

- Groundwater elevations;
- DNAPL thicknesses; and
- VOCs in groundwater.

The scope and frequency of the Detrex monitoring program is inadequate for assessing system performance and does not provide a sufficient basis for understanding how the system could be optimized based on site-specific conditions. For example, the Detrex monitoring program does not measure the necessary parameters on a frequent enough basis to understand the radius of influence (ROI) of existing wells, let alone how the system could be modified to improve the ROI of individual wells and the overall capture zone of the system. Furthermore, the number of monitoring wells for the passive DNAPL recovery system (only 7 wells; URS, 2011) and their orientation, *i.e.*, clustered near recovery wells, is inadequate to determine the ROI. Without such information, any effort to scale up the existing recovery system would be "flying blind," since Detrex cannot characterize the ROI or effectiveness of either the existing or proposed wells. In short, Detrex has no idea of the ROI of its current wells. This critical design detail is not even mentioned in the design document (URS, 2011). Without these data, there is no way to justify the proposed spacing (and number of) DNAPL recovery wells proposed, or to demonstrate that the spacing that Detrex proposes would be adequate even to accomplish its limited remedial objectives.

Detrex apparently has more recently proposed to expand the passive DNAPL recovery system, but it has not included any additional monitoring wells in this proposal (URS, 2011). The proposed monitoring program would make measurements biweekly, but measurement frequency would be reduced to monthly or quarterly, based on ongoing evaluation of the system. Proposed measurements would include:

- Water and DNAPL levels in passive DNAPL recovery wells;
- Water and DNAPL levels in existing monitoring wells proximal to the supplemental passive DNAPL recovery wells;
- Volume of DNAPL recovered at each removal event; and
- Total well depth (to evaluate siltation).

If this program is implemented, these data would be of minimal use, because the frequency of these measurements is too low and there would be no new monitoring wells installed in the vicinity of the proposed recovery wells. Thus, the proposed monitoring program would provide even less information than the current one and would therefore not be appropriate for evaluating or optimizing the proposed recovery system.

Recommended Monitoring and Data Collection Approach

The Detrex monitoring program can be improved so that it generates the types of information that is needed to evaluate system performance and to optimize system configuration prior to expanding to full scale. In addition to following our recommendations above (as described in Sections 2a-2c), system performance data should be collected and reported on a frequent basis (*e.g.*, hourly/daily/weekly) until the extraction system response is fully understood and consistent data are being produced. New monitoring wells should be located in close proximity to the extraction wells, and in sufficient geometry and number to allow a spatial representation of the capture zone and recognition of possible heterogeneities that can indicate pathways for DNAPL migration (identification of preferential migration pathways can enhance DNAPL capture with fewer wells). Initially, for our recommended small pilot system near the center of the DNAPL plume, at least 5 to 6 monitoring wells should be installed within and adjacent to the extraction well array. Site response should be monitored closely, to ensure inward gradients are being achieved, DNAPL production rates are understood, and localized monitoring wells are confirming that DNAPL thickness in the source area monitoring wells is decreasing in a steady, gradual fashion. At a minimum, the following parameters should initially be measured and analyzed on a frequency sufficient to support full scale design:

- Vacuum pressure in the DNAPL extraction wells—wells should be instrumented to collect these data continuously, beginning at system startup;
- Water and DNAPL level data—wells should be instrumented to collect these data continuously, beginning at system startup (in the DNAPL extraction wells and monitoring wells); and
- Flow rate and total volume of extracted gasses, groundwater, and DNAPL.

The full extraction well network would then be deployed on an iterative basis, using site response, yield and DNAPL pool characteristics to determine extraction well density required for full scale operation and location from site-specific operational data. Additional monitoring wells would continue to be installed and monitored as the extraction system expands in order to continue diagnosing and optimizing system performance, while also providing a means to assess overall attainment of ROD objectives.

CONCLUSIONS

In conclusion, the proposed remedy in the draft ESD is *fundamentally* different from the remedy specified in the ROD. As the changes to the ROD contemplated by the draft ESD fundamentally alter the remedy selected in the ROD, they are improperly attempted through use of an ESD rather than the ROD amendment procedure required by applicable regulations and USEPA ROD Guidance.

The proposed remedy is merely an expansion of the current Detrex system, which has failed to prevent outward migration of DNAPL from the source area. The DS Tributary has been repeatedly recontaminated and this has undermined the short term protectiveness of the Detrex remedy, as

recognized by USEPA in its Second Five-Year Review (USEPA, 2009). The ROD rejected a remedy very similar to that proposed in the ESD, and site-specific data (*e.g.*, migration of DNAPL past the slurry wall) have confirmed that the rejection of such passive remedies was (and continues to be) the correct decision. Available resources should be used to actively recover DNAPL from the source area so that the ongoing migration of Detrex DNAPL (a Principal Threat Waste) can be neutralized. Only after aggressive source control measures have been implemented should additional, complementary containment measures, such as a slurry wall, be contemplated (and only as a complement to source treatment).

The failure of Detrex to meet the ROD objectives has resulted from Detrex's failure to properly design and operate the DNAPL recovery system in a manner that efficiently captures and removes DNAPL from the subsurface. The current Detrex system is a passive gravity drainage system that recovers minimal DNAPL due to numerous design and operational flaws. The problems reported by Detrex during the 10 years of pilot operations at this site (*i.e.*, emulsion formation, excessive siltation, and crystallization) are entirely due to inappropriate system design and operational procedures. Vacuum enhanced extraction is a proven technology that can be implemented effectively at Fields Brook, if USEPA requires Detrex to adopt the design and operational recommendations described herein. USEPA should require that Detrex focus on permanent source treatment that is consistent with USEPA Principal Threat Waste guidance and CERCLA § 121(b)(1), and require Detrex to properly and expeditiously implement the ROD remedy.

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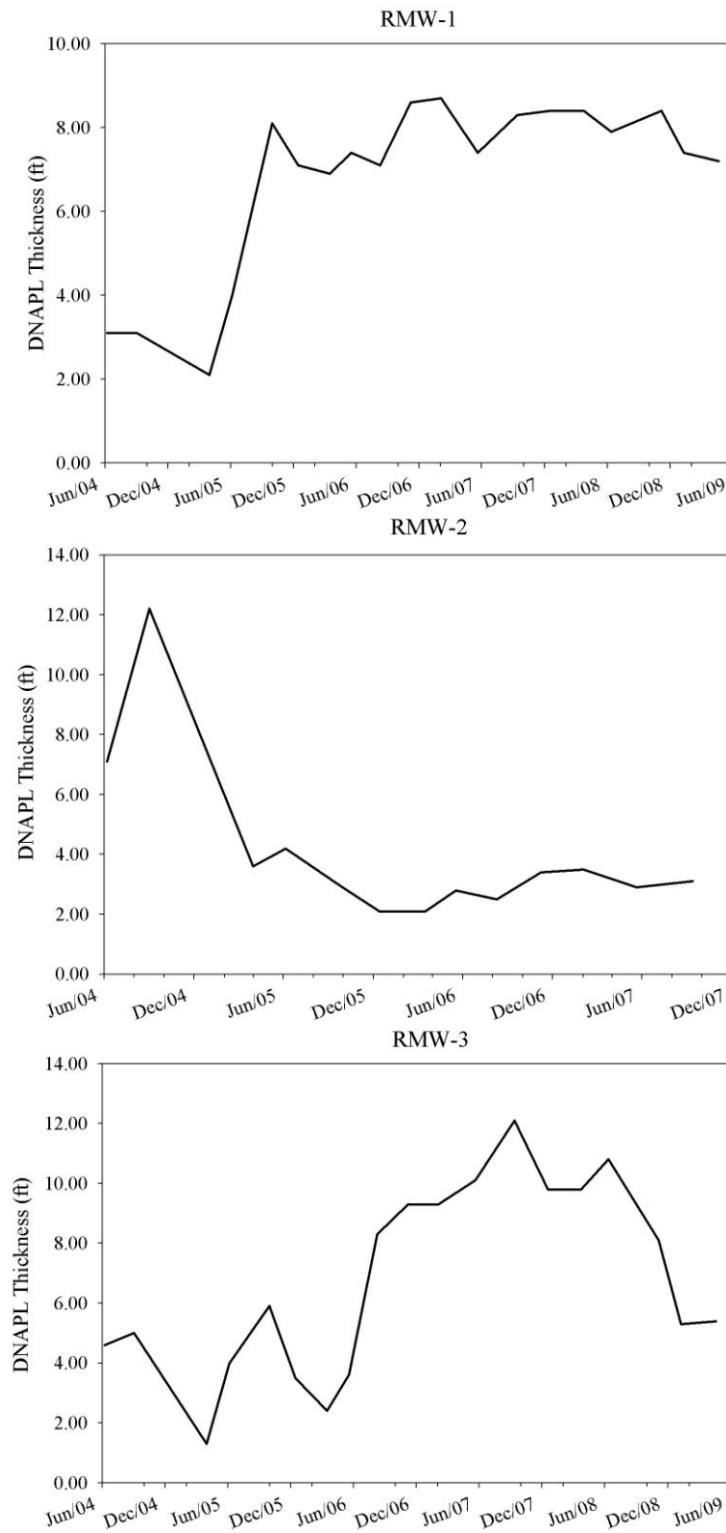
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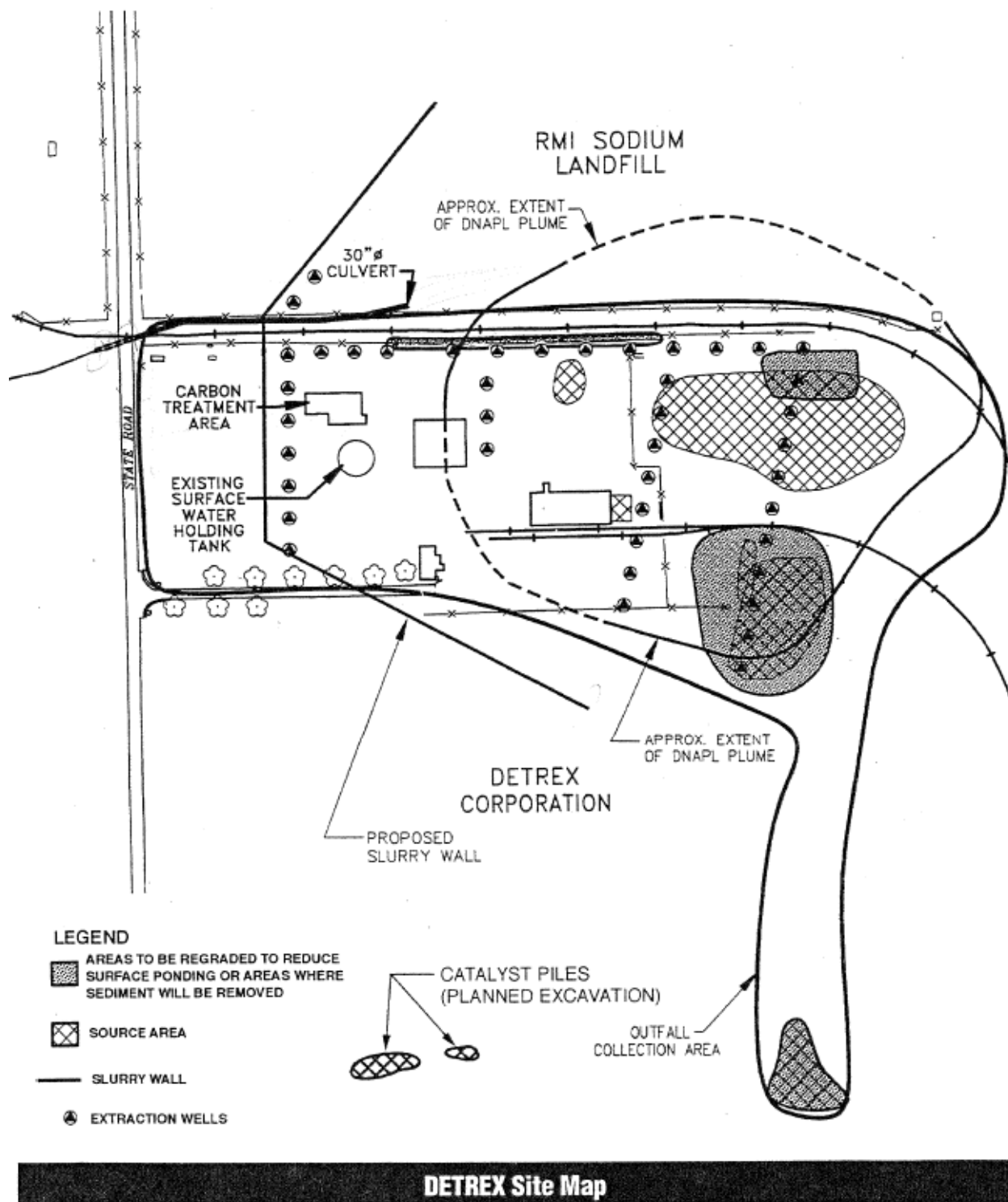
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Figure 1
DNAPL Thicknesses Observed in Detrex Source Control Monitoring Wells
Detrex Facility, Fields Brook Superfund Site, Ashtabula, OH

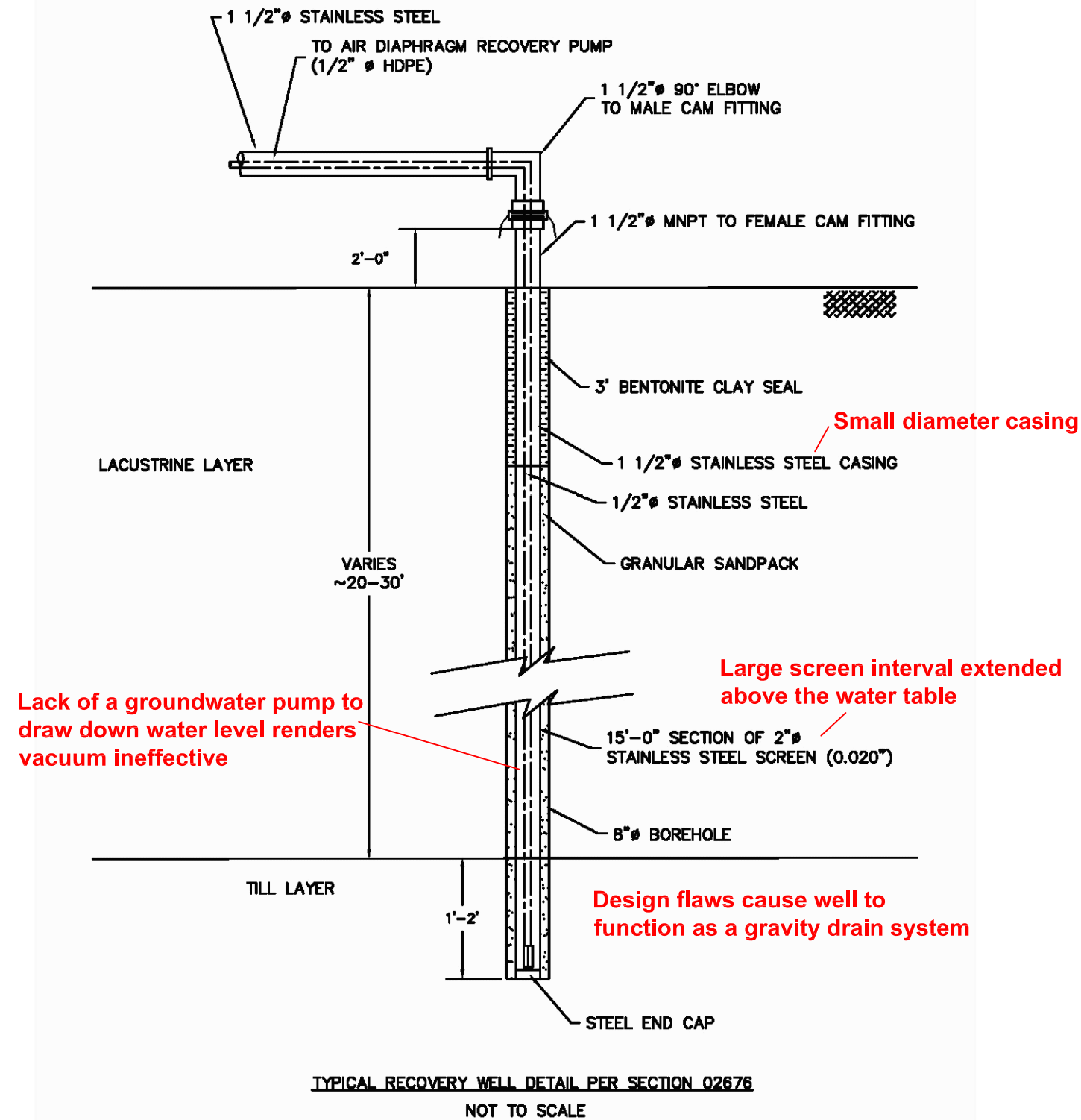


Source: Detrex Corporation. 2009. Monthly Status Report – April 2009, Fields Brook Superfund Site, Detrex Source Area, Ashtabula, Ohio. May 14, 2009.

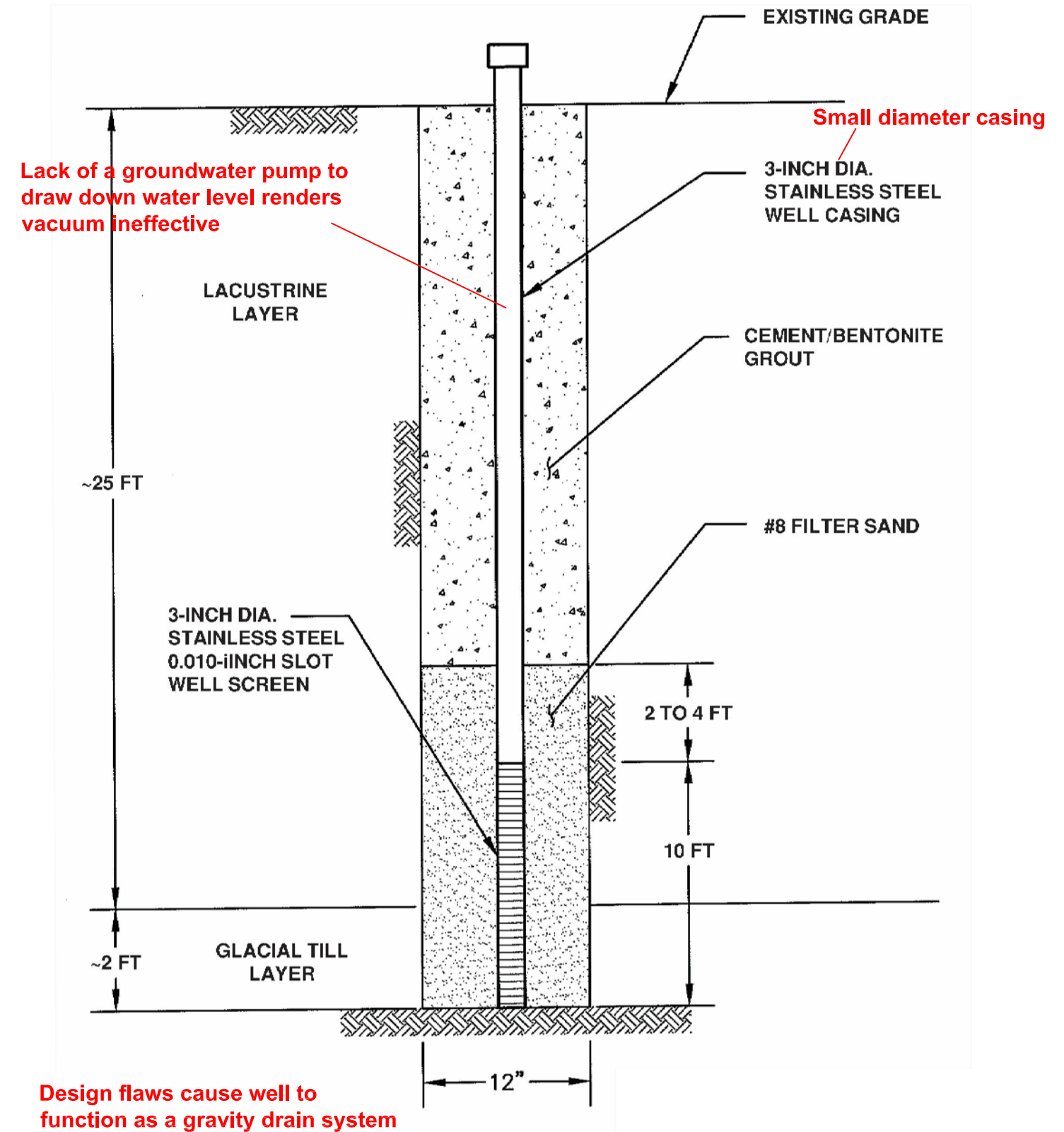
Figure 2
ROD-Recommended DNAPL Recovery Well Layout (Figure 7 from the SCOU ROD)
Fields Brook Superfund Site, Ashtabula, OH



A Well Design from the O&M Manual



B Proposed Well Design from the Detrex 2011 Recovery Well Work Plan

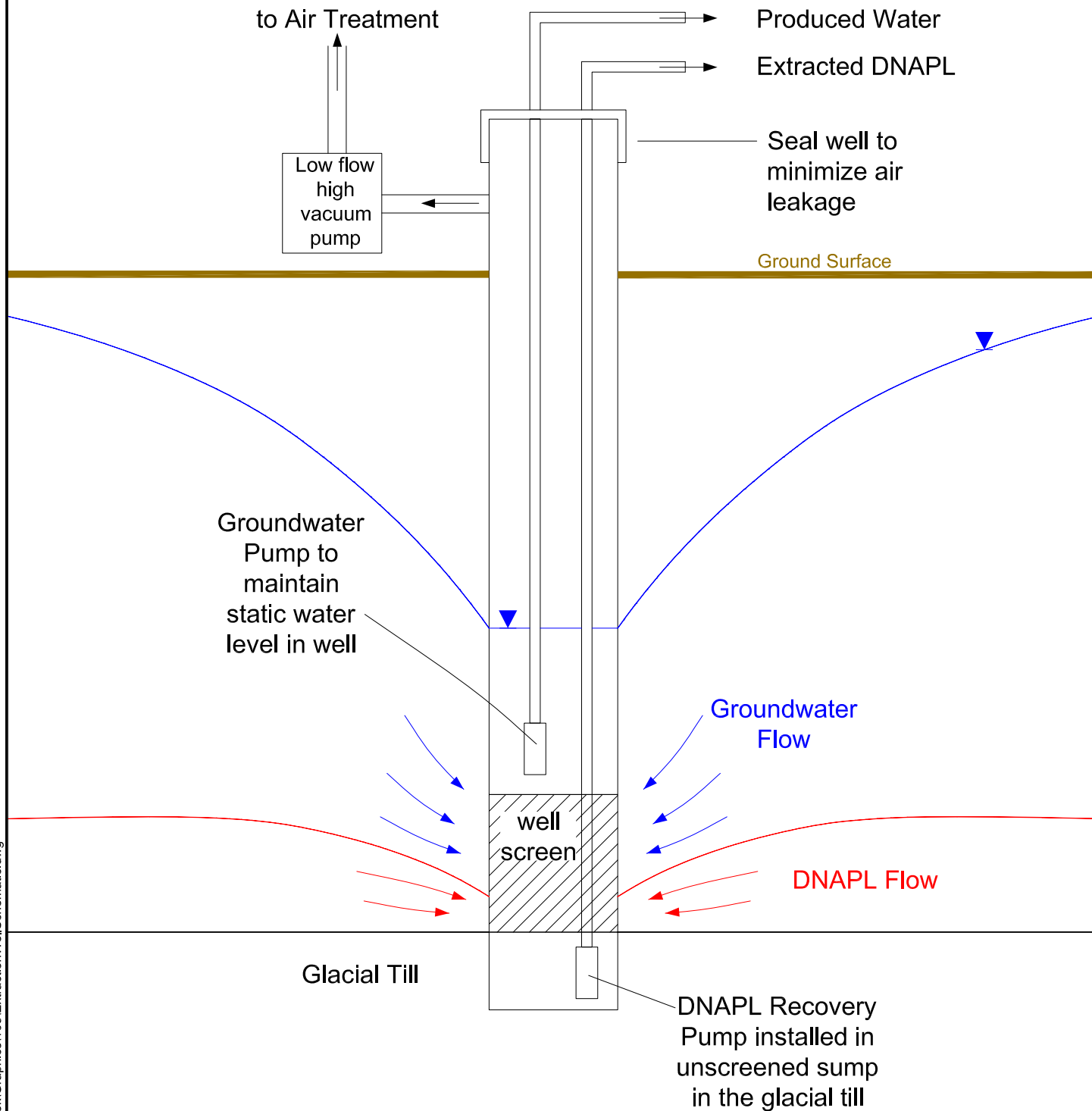


Detrex Passive DNAPL
Recovery Wells

Fields Brook Superfund Site - Ashtabula, Ohio

FIGURE
3

Date: 12/09/2011



Recommended DNAPL Extraction Well Configuration

Fields Brook Superfund Site - Ashtabula, Ohio

FIGURE
4

Date: 12/05/2011